GEOLOGY OF HUTTO QUADRANGLE

WILLIAMSON COUNTY, TEXAS

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Dean of the Graduate School

GEOLOGY OF HUTTO QUADRANGLE
WILLIAMSON COUNTY, TEXAS

THESIS

Presented to the Faculty of the Graduate School of
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of the Requirements

For the Degree of
MASTER OF ARTS

by

James E. Gordon, B. S.
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FRONTISPIECE

Upper Austin chalk in Brushy Creek, south of Hutto, Texas.

CONTENTS

ILLUSTRATIONS

Figures

Tables

ABSTRACT

This paper presents the surface geology of the Hutto Quadrangle, southeastern Williamson County, Texas. Outcropping formations are Austin chalk, Burditt marl, and Taylor marl of the Gulf series (upper Cretaceous). Six faunal zones in the middle and upper portions of the Austin group can be differentiated and used in detailed stratigraphic studies. Three Quaternary formations are mapped and described, but not formally named.

The structure of the Quadrangle is relatively simple, being part of a gentle eastward sloping homocline, faulted by the Balcones fault system.

INTRODUCTION

Purpose

This paper presents the results of stratigraphic and paleontologic studies of the Hutto Quadrangle, Williamson County, Central Texas. These results are presented by means of a geologic map of the Quadrangle (Plate I), and the accompanying text material.

Location

The Hutto Quadrangle is located in southeastern Williamson County, Texas (Fig. 1). The Quadrangle is bounded by longitudes 97° 35' W and 97° 30' W, and lattitudes N 30° 35' and N 30° 30', and comprises approximately 28 square miles. Hutto is the only town in the Quadrangle, and it is twenty miles north-northeast of Austin, Texas, on U. S. Highway 79.

Acknowledgments

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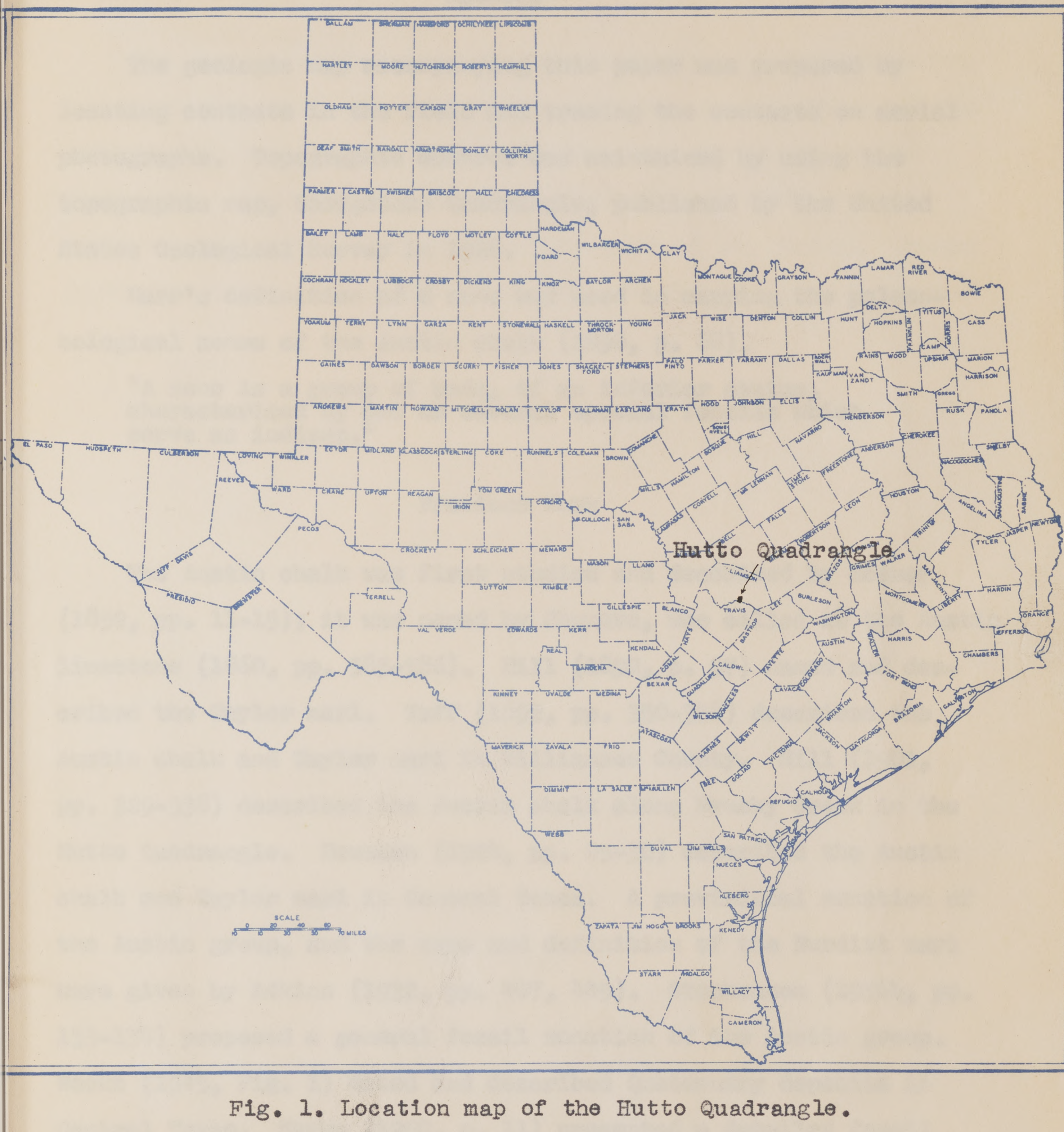

Fig. 1. Location map of the Hutto Quadrangle.

Methods

The geologic map accompanying this paper was prepared by locating contacts in the field and tracing the contacts on aerial photographs. Topographic control was maintained by using the topographic map, Georgetown Quadrangle, published by the United States Geological Survey in 1928.

Marr's definition of a zone was used in mapping the paleontological zones of the Austin chalk (1898, p. 68).

> "A zone is a group of beds, of an inferior status, characterized by one or several special fossils which serve as indices."

Previous Work

The Austin chalk was first studied and described by Roemer (1852, pp. 11-15); it was named by Shumard, who called it the Austin limestone (1860, pp. 585-586). Hill (1892, p. 97) named and described the Taylor marl. Taff (1892, pp. 350-358) described the Austin chalk and Taylor marl in Williamson County. Hill (1901, pp. 329-338) described the Austin chalk along Brushy Creek in the Hutto Quadrangle. Deussen (1924, pp. 25-32) described the Austin chalk and Taylor marl in Central Texas. A provisional zonation of the Austin group, and the name and definition of the Burditt marl were given by Adkins (1932, pp. 407, 449). Stephenson (1936b, pp. 133-134) proposed a general fossil zonation of the Austin group. Weeks (1945, Fig. 1) dated and described Quaternary deposits in Central Texas. Marks (1950, p. 11) presented a detailed fossil zonation of the Austin group along the San Gabriel River in Williamson County.

Drainage

The streams draining the Hutto Quadrangle have low gradients, and they have developed a dendritic pattern. Brushy Creek and its tributaries drain most of the area; the drainage is toward the southeast. Northeastward flowing tributaries of Mustang Creek drain a small area in the northeastern part of the region. Brushy Creek and Mustang Creek are tributaries of the San Gabriel River.

Fig. 2. Cretaceous formations of Central Texas and approximate European Stage Equivalents. (Adapted from Adkins, 1932 and Hazzard *et al.*, 1945)

SERIES	GROUP	FORMATION	EUROPEAN STAGES
Gulf	Navarro	Kemp clay	Maestrichtian
		Corsicana marl	
	Taylor	Taylor marl	Campanian
	Austin	Burditt marl	Upper Santonian Lower Santonian
		Austin chalk	Coniacian
	Woodbine	Eagle Ford shale	Turonian Upper Cenomanian
		Pepper shale	Middle Cenomanian
Comanche	Washita	Buda limestone	Lower Cenomanian
		Del Rio clay	
		Georgetown limestone	Upper Albian
	Fredericksburg	Edwards limestone	Middle Albian
		Comanche Peak limestone	
		Walnut clay	
	Trinity	Glen Rose limestone	Lower Albian
		Travis Peak formation	Upper Aptian

STRATIGRAPHY

CRETACEOUS SYSTEM

The Cretaceous system in Texas is divided into the Gulf series above and the Comanche series below. The Comanche series, composed of the Trinity, the Fredericksburg, and the Washita groups, is not exposed in the Hutto Quadrangle. Strata of the Comanche series are exposed to the west in adjacent quadrangles and dipping gently southeast, are present in the subsurface of the Hutto Quadrangle. The Gulf series is composed, from oldest to youngest, of the Woodbine, Austin, Taylor, and Navarro groups (Fig. 2). The Woodbine group does not appear in the area under consideration, but is present in the subsurface.

AUSTIN GROUP

Austin chalk

General Description

Outcrop and thickness. - The Austin chalk occurs at the surface in approximately the western two-thirds of the Hutto Quadrangle. The upper 185 feet of this formation crops out in the Quadrangle; the remainder of the lower part is exposed in the adjacent Palm Valley Quadrangle to the west. The best exposures of the Austin may be found along Brushy Creek.

Lithology. - The lower part of the Austin chalk consists of indurated, massive limestone beds that range from two to four feet thick. Separating the massive limestone beds are beds of soft, argillaceous chalk that average five-tenths of a foot thick.

The middle portion of the formation is composed of even to unevenly bedded granular limestone and fissile marl beds. The limestone beds are one foot to three feet thick, massive to nodular, and light brown to white in color. The marl beds are five-tenths of a foot to three feet thick, fissile, yellow-brown to gray, and may contain oblong, limestone concretions that are five-tenths to seven-tenths of a foot long. Silicified fossils occur in this part of the formation. Some of the limestone beds contain minute grains of a mineral that appear to be glauconite, giving the rock on close examination a "salt and pepper" appearance.

The upper part of the formation is composed of massive, micrograined, white limestone beds that are one to four feet thick, and soft, gray, marl beds five-tenths to six-tenths of a foot thick. This part of the formation contains biostromes of the shells of Gryphaea aucella Roemer.

Several thin sections were made of the limestone in each of the fossil zones of the Austin chalk. The limestone beds in the Inoceramus undulatoplicatus, Exogyra ponderosa, and Exogyra laeviuscula zones were similar. The structure of the limestone was best seen at 43X magnification. The limestone beds of these zones contain minute clusters of transluscent calcite crystals surrounded by coarser crystalline, clear calcite. Pelecypod shell fragments and foraminiferal tests are present in the limestones of all three zones, but they are more abundant in the limestone of the E. ponderosa and E. laeviuscula zones. The limestone beds of the E. laeviuscula zone, in addition to the above properties, contain an abundance of finely disseminated iron grains.

In thin section the limestones of the Hemiaster texanus and Ostrea travisana zones show similar microlithology to each other. These limestones are composed of coarse crystalline, clear calcite surrounding large clusters of transluscent, finely crystalline calcite. Fragments of pelecypod shells and foraminiferal tests are abundant in the thin sections. Fine iron grains are present in limestone beds from both zones, but are more abundant in the H. texanus limestone. The limestone from the O. travisana zone also contains minor amounts of glauconite grains and well rounded, clear, quartz grains.

Topography. - The Austin chalk underlies part of the Blackland Prairie. The topography consists of low, rounded hills. The Austin chalk is sufficiently resistant to erosion to form nearly vertical bluffs along Brushy Creek where the limestone and marl beds produce an alternation of projecting and receding ledges.

Soils and vegetation. - The soils formed from the Austin chalk are not true prairie soils because of their high calcareous content. They are brown to black with a gray subsoil and contain an abundance of organic material which is characteristic of prairie soils (Soils and Men 1938, p. 110). The soils are thin on the steeper slopes, but are fairly deep on the flatter areas. They are sticky when wet, causing ungravelled roads to be impassable to automobile travel. When dry the soils crumble readily between the fingers and are finely granular.

The Austin chalk originally supported a prairie type of vegetation consisting predominantly of Andropogon grasses with occasional clumps of live oaks (B. C. Tharp, personal communication). Intensive cultivation in modern times has left only remnants of the original prairie vegetation. Appendix B is a list of the plants growing on the Austin group in the Hutto Quadrangle.

Chemical composition. - The following chemical analyses of the Austin chalk were made by G. H. Wooten, and published by Taff (1892, pp. 351-352). From the localities given by Taff the writer was able to determine that sample I was collected on Brushy Creek, six and five-tenths miles east of Round Rock, Williamson County, and is from the *Inoceramus undulatoplicatus* zone of this paper. Sample II was collected on Brushy Creek, about three miles southeast of Hutto, and is from the *Ostrea travisana* zone of this paper.

	I	II
Silica (SiO_2)	5.94	10.32
Alumina (Al_2O_3)	1.41	5.41
Ferric oxide (Fe_2O_3)	1.31	1.15
Lime (CaO)	48.73	45.31
Sulfuric anhydride (SO_3)	.42	1.04
Soda (Na_2O)	2.60	2.07
Potash (K_2O)	.20	.17
Water at 100° C.	.82	.51
Carbon dioxide (CO_2)	37.84	34.44
Phosphoric acid (P_2O_5)	.142	.218
	99.412	100.638

Environment of Deposition

Johnson (1949, p. 15) states that chalks are fine-grained, pure or nearly pure limestones. Twenhofel (1939, p. 324) states that limestones are deposited mostly at depths of less than two or three hundred meters, with an absence of terrigenous sediments. Cloud and Barnes (1946, p. 80) state further that chemically precipitated limestones were deposited in a tropical to semi-tropical region, in shallow water of restricted circulation, with an introduction from time to time of fresh water rich in calcium and carbonate.

The Eagle Ford shale underlies the Austin chalk, and has been interpreted by Adkins (1932, p. 417) as a shallow marine water deposit. It seems unlikely that the sea was much deeper during Austin time, because there is no evidence in the rocks to indicate that there was a great subsidence of the sea floor following Eagle Ford time. The presence in the Austin chalk of thick shelled, benthonic, shallow water pelecypods such as *Inoceramus* spp., *Ostrea travisana* Stephenson, and *Exogyra ponderosa* Roemer, and the presence of biostromes consisting of shells of *Gryphaea aucella* Roemer indicate water not over twenty fathoms deep if these fossils are interpreted as Scott (1940, p. 1168) has interpreted similar fossils. Many of the nodular limestone beds in the *Ostrea travisana* zone of the Austin chalk contain broken and reworked shells, which may indicate the sea bottom was reached by wave action. The number and variety of fossils, such as *Gryphaea wratheri* Stephenson, *G. aucella* Roemer, *Ostrea travisana* Stephenson, *Idonearca* sp., *Neithea casteeli* Kniker, *Spondylus guadalupae* Roemer, and *Texanites* of several species, found in the *Ostrea travisana* zone indicate the presence of an environment with the optimum conditions for life.

The writer believes that the above mentioned facts indicate that the Austin chalk was deposited in a clear, warm, shallow (depth of 120 feet or less), marine sea, with optimum conditions prevailing for organic activity during deposition of the rocks composing the Ostrea travisana zone.

Paleontology

Marks (1950, p. 11) proposed a detailed zonation of the Austin group, based on exposures along the San Gabriel River, Williamson County. His zones were, from oldest to youngest: Inoceramus subquadratus Schlüter, Gryphaea wratheri Stephenson, Inoceramus undulatoplicatus Roemer, Hemiaster texanus Roemer, Ostrea travisana Stephenson, Exogyra ponderosa Roemer, Exogyra laeviuscula Roemer, Exogyra tigrina Stephenson, and Ostrea centerensis Stephenson. The first two zones do not crop out in the area under consideration, but are exposed approximately two miles to the west. The Exogyra tigrina zone is combined with the E. laeviuscula zone in this paper.

Inoceramus undulatoplicatus zone

Outcrops and thickness. - The Inoceramus undulatoplicatus zone is exposed in a small area in the western part of the Quadrangle. North of Brushy Creek it is covered by terrace deposits, but it is well exposed south of Brushy Creek at the base of Ray's Bluff (Plate I).

Lithology. - This zone consists of hard, massive, black to gray when weathered, white when fresh, micrograined limestone beds two to four feet thick. The limestone beds are separated by soft, fissile, blue-gray interbeds of marl. In thin section the limestone shows calcite crystals, pelecypod shell fragments, and Foraminifera to be present. The crystalline structure of the limestone is that of minute, transluscent calcite crystals surrounded by coarser crystalline calcite.

Fossils. - Inoceramus undulatoplicatus were not abundant in that part of the zone present. They were sufficiently abundant and well preserved to permit ready identification of the zone. They may be collected at locality 8 (Plate I). Fossils found associated with I. undulatoplicatus were:

Gryphaea wratheri Stephenson
Idonearca sp.
Eutrephoceras sp.
Spondylus guadalupae Roemer
Parapachydiscus sp.

Hemiaster texanus zone

Outcrops and thickness. - The Hemiaster texanus zone appears as a V-shaped pattern in the west central part of the geologic map of the Hutto Quadrangle. The best exposures are found at Ray's Bluff (Plate I). The H. texanus zone is estimated to be 29.5 feet thick, but a complete section could not be measured because of faulting.

Lithology. - This zone is composed of indurated, massive, brown to gray when weathered, yellow-brown to white when fresh, granular limestone beds two or three feet thick. The limestone is interbedded with soft, fissile, yellow-brown to gray marl beds about five-tenths of a foot thick. In thin sections it can be seen that the limestone of this zone contains coarse-grained, transparent to transluscent calcite, pelecypod shell fragments, and finely disseminated grains of ferruginous matter.

E. ponderosa

Contact

O. travisana

A. Contact between the *Exogyra ponderosa* and *Ostrea travisana* zones, 350 yards east of the iron bridge crossing Brushy Creek, which is two and one-half miles south of Hutto.

O. travisana

Contact

H. texanus

B. Contact between *Ostrea travisana* and *Hemiaster texanus* zones in Channel Creek, 500 yards north of U. S. Highway 79.

<u>Soils and vegetation</u>. - The <u>Hemiaster texanus</u> zone weathers to a thin, granular, calcareous soil. On steep slopes the soil is pebbly. The dominant vegetation is cedar, <u>Yucca</u>, prickly pear, and <u>Aristida</u> grasses.

<u>Fossils</u>. - <u>Hemiaster texanus</u> Roemer first appears in the Austin chalk in this zone, and its vertical range extends into the overlying <u>Ostrea travisana</u> Stephenson zone. This zone contains abundant fossils. Among those collected were:

<u>Gryphaea wratheri</u> Stephenson
<u>G. aucella</u> Roemer
<u>Eutrephoceras</u> sp.
<u>Spondylus guadalupae</u> Roemer
<u>Neithea casteeli</u> Kniker
<u>Idonearca</u> sp.

<u>Ostrea travisana</u> zone

<u>Outcrops and thickness</u>. - The <u>Ostrea travisana</u> zone is exposed in the west and central part of the area. The best exposures may be found in Brushy Creek at the base of Jake's Hill and in Channel Creek, 500 yards north of U. S. Highway 79 (Plate I). The <u>Ostrea travisana</u> zone is approximately 36 feet thick (Plate II), but a complete section could not be measured because of faulting.

<u>Lithology</u>. - This zone contains beds two to four feet thick which are composed of well indurated, massive to nodular, brown to gray when weathered, pale brown to white when fresh, granular limestone. The limestone is interbedded with marl beds which are fissile, friable, yellow-brown to gray, and one foot to two feet thick. The limestone beds in the upper part of the zone contain small grains of glauconite, which give the rock a "salt and pepper" appearance.

Marcasite-pyrite concretions up to an inch in diameter were present in 60 per cent of the beds, and in two or three of the marl beds marcasite-pyrite concretions are concentrated, giving the beds a yellow-brown color. Some of the marl beds contain oblong, well indurated, white to gray, fossiliferous limestone concretions from five-tenths to seven-tenths of a foot long. The massive limestone beds have a fairly wide horizontal extent. The nodular strata and marl interbeds rapidly thicken and thin, and often pinch out within a short horizontal distance.

Thin sections of limestones from this zone contain coarsely crystalline transparent calcite with large clusters of transluscent calcite crystals. Numerous shell fragments and Foraminifera occur with minor amounts of iron and well rounded, clear, quartz grains. Dark green mineral grains found in the limestone beds were examined under a petrographic microscope by S. E. Clabaugh. He reports that,

> "the mineral grains are surrounded and included with minute calcite crystals which tend to obscure the optical properties of the green mineral. The index of refraction is about 1.59 which would indicate glauconite, but the mineral could possibly be altered grains of serpentine".

Soils and vegetation. - The Ostrea travisana zone weathers to a thin, pebbly, light-brown, calcareous soil. The dominant vegetation is cedar, prickly pear, Yucca, mesquite, and Stipa and Aristida grasses.

Fossils. - Ostrea travisana Stephenson is found only at this horizon in the Hutto Quadrangle, but it has been reported by Stephenson (1936a, p. 1) as occurring in the upper part of the Burditt marl in northern Travis County. This zone represents a period of ideal conditions in the Austin chalk for marine organisms. Fossils are very numerous, and ammonites, especially, are more numerous in this zone than in any of the other zones. The following fossils were found in this zone:

<u>Gryphaea wratheri</u> Stephenson
<u>G. aucella</u> Roemer
<u>Eutrephoceras</u> sp.
<u>Spondylus guadalupae</u> Roemer
<u>Neithea casteeli</u> Kniker
<u>Gastropoda</u>
<u>Hemiaster texanus</u> Roemer
<u>Trigonia</u> sp.
<u>Texanites internodosus</u> Renz
<u>T. texanus</u> (Roemer) Spath
<u>Barroisiceras</u> sp. aff. <u>dentatocarinatum</u> (Roemer)

<u>Exogyra ponderosa</u> zone

<u>Outcrops and thickness</u>. - The <u>Exogyra ponderosa</u> zone has an outcrop that is much wider than the outcrops of the other zones, and comprises approximately one-fourth of the outcrop surface of the Austin chalk in the Hutto Quadrangle. The zone is exposed in the southwestern, central, and northwestern parts of the area under consideration. A complete section of this zone was measured at Jake's Hill; it was 67 feet thick.

<u>Lithology</u>. - The <u>Exogyra ponderosa</u> zone contains massive, indurated to soft, white to gray when weathered, white when fresh, micrograined limestone beds from one foot to four feet thick, with fissile, friable, blue-gray interbeds of marl from five-tenths to six-tenths of a foot thick. Marcasite-pyrite concretions up to an inch and one-half in diameter are present in the lower twenty feet. The one- or two-foot limestone beds are confined to the lower 36 feet. The <u>E. ponderosa</u> zone is very fossiliferous, and near the middle it contains biostromes

of shells of Gryphaea aucella Roemer. In thin section the limestone is composed of minute globular masses of transluscent calcite surrounded by finely-crystalline, transparent calcite. Fragments of pelecypod shells and foraminiferal tests are abundant.

Soils and vegetation. - The Exogyra ponderosa zone weathers into a black soil with a grayish-white subsoil. The soils are usually deep on low flat areas and on gentle slopes, but become thin on the steeper slopes. The dominant vegetation consists of Andropogon grasses and live oak trees on the deep soils, and Yucca, red bud, hackberry, and buckeye on the thin soils.

Fossils. - Exogyra ponderosa Roemer var. first appears in the Austin chalk in the lower part of the E. ponderosa zone, and ranges upward into the Taylor marl. These fossils are very abundant, and they may be easily collected wherever the zone is exposed. The best collecting area for E. ponderosa var. is at locality 7 (Plate I). A prominent biostrome of shells of Gryphaea aucella Roemer occurs twenty feet from the base of this zone in the area under discussion. The lower fifteen feet of the biostrome consists of indurated, white chalk beds with interbeds of argillaceous chalk. This part of the biostrome contains numerous mature G. aucella shells. The next eight to twelve feet of the biostrome consists of thin bedded, soft, argillaceous chalk and marl beds, containing numerous juvenile G. aucella shells. Juvenile G. aucella are restricted to this horizon in the Hutto Quadrangle. Terebratulina guadalupae Roemer was collected approximately eleven to sixteen feet below the top of this zone in an argillaceous chalk bed. This fossil was not found at any other stratigraphic position. It serves as a useful sub-zone of the E. ponderosa zone.

Exogyra laeviuscula zone

Outcrops and thickness. - The *Exogyra laeviuscula* zone may be seen as a narrow, sinuous band that is abruptly terminated by major faults. South of Brushy Creek the zone may be easily traced because it is more resistant to weathering than the overlying Burditt marl, and it tends to form a ledge. North of Brushy Creek, in most places, the zone is covered by a deep soil mantle, and tracing it is more difficult. The best exposures may be observed near the top of Jake's Hill (Plate I) and at locality 5 (Plate I). This zone is four feet thick at Jake's Hill, but the thickness varies from three to six feet at other places.

Lithology. - This zone consists of a massive, hard, white to gray when weathered, pale brown to white when fresh, fine-grained, shelly limestone bed, becoming slightly softer and argillaceous in the upper foot. Marcasite-pyrite concretions, one-tenth to two-tenths of a foot long, are common, and a concentration of marcasite-pyrite and glauconite can be observed in the upper three-tenths foot of this zone. In thin sections the chalk matrix is similar to the underlying *E. ponderosa* zone, except for more abundant finely disseminated ferruginous matter.

Fossils. - Numerous shells of *Exogyra laeviuscula* Roemer were noted. The short vertical range and abundance of *E. laeviuscula* make this fossil very valuable in mapping faults in the area. *Exogyra tigrina* Stephenson was found restricted to the upper one foot of the zone. A fragment of an ammonite *Glyptoxoceras* sp. was found.

Burditt Marl

General Description

Contacts. - The Burditt marl was reported by Plummer *et al.* (1949, p. 60) to be separated from the Austin chalk by a disconformity in northern Travis County. In the Hutto Quadrangle the contact between the Burditt and Austin is marked by a concentration of marcasite-pyrite concretions and glauconite. The concentration of marcasite-pyrite and glauconite at the contact is believed by the writer to indicate a disconformity. The contact between the Burditt marl and overlying Taylor group was reported by Stephenson (1936b, pp. 133-136) to represent a regional unconformity. The upper part of the Burditt marl was either faulted out by the Shilo fault (Plate I) or covered by gravels and could not be observed.

Outcrops and thickness. - The outcrop of the Burditt marl is discontinuous in the area. It is exposed in the southern and northwestern parts, but has been faulted out by the Shilo fault in the central part of the area. The best exposure is six-tenths of a mile southeast of the Mexican Cemetery, where the Burditt marl forms the top of an eastward facing bluff. Adkins (1932, p. 450) reported the Burditt marl as being 40 feet thick in northern Travis County, but only the lower twenty feet could be measured by the writer in the area under consideration.

Lithology. - The Burditt is a soft, compact, yellow-brown marl. It has a massive appearance on fresh exposure, but becomes slightly fissile and friable on weathering. The lower two feet of the Burditt consists of soft, argillaceous chalk that contains fine grains of glauconite and limonite.

Plate IV.

Burditt

Austin

A. Contact between Burditt marl and Austin chalk in the bed of a creek, one mile east of Highway 365 and three miles southwest of Hutto.

B. Burditt marl, six-tenths of a mile southeast of the Mexican Cemetery.

Topography. - In outcrops the Burditt forms the cap of hills underlain by the Austin chalk at most places in the area. It weathers easily and because of this forms flats and slightly rounded hills.

Soils and vegetation. - This formation weathers into a deep, fine-textured, calcareous soil, which is grayish-black in color. Prairie grasses, with an occasional mesquite tree, are the dominant types of vegetation.

Paleontology

Ostrea centerensis zone. - That portion of the Burditt marl, exposed in the Hutto Quadrangle, is typified by *Ostrea centerensis* Stephenson. This fossil is abundant and serves as a good index fossil. *Parapuzosia* sp. occurs in the lower two feet of this zone. *Exogyra ponderosa* Roemer var. and *Durania* sp. were collected.

Ostrea travisana zone. - Stephenson (1936b, p. 134) reported the *Ostrea travisana* zone in the upper part of the Burditt marl in Travis County. This fossil was not found at its reported stratigraphic level in the area under discussion, probably because of poor outcrops of the upper part of the Burditt marl.

Taylor Marl

Outcrops and thickness. - Only the older beds of the Taylor marl crop out within the Hutto Quadrangle. Such strata cover approximately the eastern one-fourth of the area. The best exposures are in Brushy Creek, downstream from the Shilo fault. Fifty per cent of the bedrock Taylor is overlain by terrace gravels. The thickness of the Taylor in the area could not be determined, because outcrops were few and scattered, and there was no means for correlating them.

Lithology. - The Taylor consists of a soft, blue-black when fresh, blue-gray when weathered, even-textured, compact calcareous clay. It is slightly fissile, and friable on weathered surfaces, and contains numerous small joints that have been filled with calcite and limonite. When broken with a hammer, the marl exhibits an angular to subconchoidal fracture. When moist it may be easily carved with a pocket knife.

Topography. - The Taylor marl weathers rapidly on exposure and forms an extensive, undulating prairie in the eastern part of the area. Elevations range from 600 feet at Brushy Creek to 680 feet in the northeastern part. The Taylor marl does not form vertical cliffs along creeks.

Soils and vegetation. - This formation weathers to a very deep, calcareous soil of fine consistency, being very black, with a gray subsoil, and much deeper than the typical soil derived from the Austin chalk. The blackness of the soil is caused by an abundance of organic matter derived from the grassy vegetation. When dry, the soil is soft and friable, but it becomes very gummy and sticky when wet. The Taylor marl soils make the best farmland in the area, and they are intensively cultivated. Only sporadic occurrences of the natural vegetation were found, because of the intensive cultivation. Andropogon scoparius, A. saccharoides, and Buchloë dactyloides were found growing along uncultivated fence rows and drainage ditches. Mesquite trees are the dominant woody growth. Live oak trees, so typical of the Austin chalk, are absent on the Taylor soils.

Paleontology. - The Taylor marl contains numerous specimens of large *Exogyra ponderosa* Roemer. These fossils are more resistant to erosion than their marl matrix, and they protrude from the face of an outcrop. Internal molds of *Inoceramus* sp. occur with *E. ponderosa*.

QUATERNARY SYSTEM

Rocks of Quaternary age consist of flint gravels, limestone gravel terraces of Brushy Creek, and recently deposited sands and silts along stream courses. These deposits have not been formally named. The writer has applied the name "Upland" to the flint gravels, and "Brushy Creek" terraces to the limestone gravels. These names are only valid for the area under discussion. Weeks (1945, Fig. 1) dated gravel deposits similar to the "Upland" as early Pleistocene, and dated the "Brushy Creek" terraces as Beaumont (First Street) in age.

"Upland" gravels

General description

"Upland" gravels are found in the central and north central part of the area. They occur at altitudes ranging from 650 to 750 feet. The gravels found at altitudes of less than 680 feet are probably not *in situ*, but have been lowered by erosion of the underlying chalk and marl. These gravels unconformably overlie the Austin chalk, Burditt marl, and Taylor marl, and represent remnants of a once extensive gravel deposit. The best exposures of this formation may be seen one and one-half miles north of Hutto on the road from Hutto to Jonah. The gravels consist of oblong, brown cobbles and

A. "Upland" gravels, one and one-half miles north of Hutto on the road from Hutto to Jonah.

B. "Brushy Creek" terrace 2, in a gravel pit, 1100 yards northwest of the Shilo Cemetery.

pebbles of flint which have angular or slightly rounded edges. The gravels are hard, brittle, and very resistant to weathering.

The origin of the "Upland" gravels is a question that has yet to be answered completely. Taff (1892, pp. 364-365) stated that the gravels were derived from Lower Cretaceous formations. Hill (1901, pp. 347-349) stated that the gravels were derived from the destruction of the Edwards limestone, and are deposits formed when the Edwards was being stripped from the Edwards Plateau. Weeks (1945, p. 1718) believed that the gravels originated from the destruction of the Edwards Plateau when the streams were cutting deeply into the land surface.

"Brushy Creek" terraces

Terrace 2

Outcrops and thickness. - "Brushy Creek" terrace 2 is the oldest and highest terrace of Brushy Creek in the Hutto Quadrangle. It extends across the Quadrangle and roughly parallels the course of the stream. The best exposures are found in a gravel pit on the south side of U. S. Highway 79 two miles west of Hutto, and in a gravel pit 1100 yards northwest of the Shilo Cemetery. At the latter locality the terrace is sixteen and eight-tenths feet in thickness.

Lithology. - "Brushy Creek" terrace 2 consists of well-rounded, well stratified, limestone pebbles, and massive, fine, reddish-brown sand. The sand occurs as irregular stringers and lenses between the more persistent gravel beds. The pebbles on fresh surfaces are usually hard, micrograined limestone. About ten per cent of the pebbles are coarsely crystalline, brown limestone.

Remnant of native prairie in Hutto Cemetery,
1.6 miles south of Hutto.

Topography. - The topography developed on this terrace is a flat plain, gently sloping to the southeast. Elevations range from 620 feet on the western edge to 580 feet on the eastern edge of the Quadrangle, giving the terrace plain a slope of approximately forty feet in five miles.

Soils and vegetation. - Deep, black, calcareous soils are found on this terrace. The subsoil is brownish-red, because of the presence of reddish-brown sand in the formation. The terrace supports a prairie grass type of vegetation. A small patch of native prairie is located on this terrace at the Hutto Cemetery, one and one-half miles south of Hutto.

Terrace 1

Outcrops and thickness. - Terrace 1 is the youngest and lowest terrace of Brushy Creek. It parallels the stream from the central to the eastern edge of the area, and forms irregular strips from 200 to 800 yards wide. The best exposure is in a gravel pit on the east side of the road 1200 yards south of the Hutto Cemetery, where the gravels are ten and five-tenths feet thick.

Lithology. - This terrace is composed of well-rounded, loosely consolidated, and poorly stratified limestone pebbles. The pebbles are usually coarsely crystalline, brown limestone, with a smaller percentage of micrograined, gray limestone pebbles. Occasionally there is a boulder of soft, white chalk. Weathered shells of *Exogyra ponderosa* Roemer and *Gryphaea aucella* Roemer were found in this terrace. These fossils are derived from the Austin chalk and indicate a local origin for the terrace.

Soils and vegetation. - A black, calcareous soil and a gray subsoil are found weathering from this terrace. The dominant vegetation consists of prairie grasses, live oak, hackberry, pecan, sycamore, red bud, and buckeye trees.

Recent alluvium

General description

The Recent alluvial deposits occur along most of the stream courses, but the best exposures are found in Brushy and Cottonwood Creeks in the southeastern corner of the area. These deposits are brown to gray silts, sands, and clays. The clays contain caliche nodules and a minor amount of sand. Occasionally thin stringers of limestone pebbles can be seen.

STRUCTURAL GEOLOGY

Faults

Regional. - A major structural feature of Central Texas is the Balcones fault zone which strikes northeast. The faults traversing the area under discussion are parts of the Balcones fault system.

Local. - There are three faults of major importance in the area. They are named the Shilo, the Brushy Creek, and the Jonah faults (Plate I) for convenience of reference. These faults are normal or gravity faults with the downthrown side toward the southeast.

The Shilo fault is exposed in the bed of Brushy Creek approximately 150 yards south-southeast of the Shilo Cemetery. At this locality the lower Taylor marl is brought into contact with strata of Austin chalk. The *Gryphaea aucella* (juvenile shells) biostrome of the *Exogyra ponderosa* zone is exposed on the Austin chalk side of the fault in Brushy Creek. Samples taken from the Taylor marl on the opposite side of the fault were analyzed by Mrs. Helen Jeanne Plummer for their foraminiferal content. Mrs. Plummer stated that the Foraminifera indicated that the samples were obtained from the lowermost part of the Taylor marl. With this evidence it was possible to determine the minimum displacement of the fault to be 75 feet. The fault strikes fourteen degrees northeast, and is covered by terrace deposits to the north and south of Brushy Creek.

The Brushy Creek fault can be observed to the best advantage seven-tenths of a mile west-northwest of the iron bridge crossing Brushy Creek, which is two and one-half miles south of Hutto. At this locality the Burditt marl (*Ostrea centerensis* zone) is faulted

A. Shilo fault in Brushy Creek, 150 yards southeast of the Shilo Cemetery.

B. Brushy Creek fault, seven-tenths of a mile west-northwest of the iron bridge crossing Brushy Creek, which is two and one-half miles south of Hutto.

against the Gryphaea aucella (juvenile shells) biostrome of the Exogyra ponderosa zone. The displacement of this fault is approximately 40 feet. The strike of the fault changes from 41 degrees to 28 degrees northeast.

The Jonah fault was named and mapped by Marks (1950, geologic map) in the Jonah Quadrangle which is north of and adjacent to the Hutto Quadrangle. The fault traverses the northwestern corner of the Quadrangle. The actual fracture could not be found, but the Ostrea travisana zone and Burditt marl (Ostrea centerensis zone) are exposed a short distance apart on opposite sides of the suspected fault. A cross section through the zone (Plate I) indicates the displacement to be 80 or 90 feet. The strike of the fault is approximately 38 degrees northeast.

A number of smaller faults were found in Brushy Creek and its tributaries. These faults have not more than eight feet of displacement, and their strike is north or northeast. In Brushy Creek, south of the Lutheran Cemetery, four small faults form a horst and graben.

The age of the faulting in the area is post-Taylor and pre-Quaternary.

Attitude of Strata

Regional. - The exposed Cretaceous strata in the area have been reported by Sellards (1934, p. 48) to be part of a homocline which gently dips to the southeast at a rate of 90 to 100 feet per mile. The formations have a general northeast strike in Central Texas.

Local. - Local dips measured in the Austin chalk varied from one to seven degrees to the southeast. The local variations in dips are believed to result from faulting.

HISTORICAL GEOLOGY

At the close of Comanchean time the sea had retreated from the Central Texas region. The rocks of the Woodbine group in Central Texas mark the beginning of a new advance of the Cretaceous sea (Hill 1901, p. 371). The Austin chalk in the area under discussion records a part of the history of this advancing sea. The sea was shallow (less than twenty fathoms deep), clear, and warm. The lack of detrital sediments during deposition of the Austin chalk suggests that the land areas surrounding the sea were either low lying or a great distance away. During Austin time the encroaching sea reached its maximum extent after which time it began to retreat (Adkins 1932, pp. 260-261). The Burditt marl and Taylor marl may represent the beginning of this gradual withdrawal. The sea remained shallow, and this is evidenced by the presence of the thick shelled Exogyra ponderosa Roemer; but, whereas the sea was fairly clear during Austin time, the sea during Taylor and Burditt time was the site of deposition of a considerable quantity of clay. This may possibly indicate that the land surrounding the Burditt and Taylor seas was undergoing a gradual uplift.

The Quaternary deposits in the area constitute a record of stream action. The "Upland" gravels probably represent a time when extensive areas of the Edwards Plateau were being eroded. The "Brushy Creek" terraces record a time when Brushy Creek and its tributaries were eroding the surrounding Cretaceous rocks of the region.

ECONOMIC GEOLOGY

Oil and Gas

Two wells in search of oil have been drilled in the Quadrangle. The W. W. Reeves, Stern No. 1 was drilled six-tenths of a mile west-northwest of Hutto. A log of this well is not available. The W. M. Jarrell, Avery No. 1 was drilled two and four-tenths miles east-southeast of Hutto, and bottomed in schistose shales of pre-Cambrian age. A micropaleontology and electric well log of this well is available in the office of University Lands, University of Texas, Austin, Texas. Both of these wells were dry holes.

Road Metal

The area has an abundance of gravels suitable for road metal. The terrace gravels of Brushy Creek are extensive, and may be used for either concrete aggregate or surface gravel. The "Upland" gravel deposits are too thin to be economically useful for road metal.

Water

Water in the area is usually obtained from shallow hand-dug wells that produce from either the base of the terrace gravels or the Austin chalk. These wells do not furnish an adequate supply during dry years. Hutto is supplied with an average of about 10,000 gallons of water a day, which is pumped from a well 790 feet deep (Cumley, et al. 1942, p. 2). The Hutto well is probably producing from portions of the upper Edwards limestone.

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Appendix A:

Measured Sections

Section 1. Upper *Inoceramus undulatoplicatus* Roemer zone and lower *Hemiaster texanus* Roemer zone, at Ray's Bluff, six-tenths of a mile upstream from Hutto to Pflugerville road No. 685 crossing Brushy Creek.

Bed	Description	Thickness Feet
	Hemiaster texanus Roemer zone	
13.	Chalk, alternating hard to soft, two to three inch beds, brown to gray when weathered, gray to white when fresh, granular, contains *Neithea casteeli* Kniker, and abundant *Idonearca* sp.	15.2
12.	Marl, soft, yellow-brown when weathered, gray when fresh, slightly fissile	0.7
	Inoceramus undulatoplicatus Roemer zone	
11.	Limestone, hard, massive, fine grained, gray-black when weathered, gray-white when fresh, contains *Idonearca* sp., forms distinct ledge	4.0
10.	Marl, soft, blue-gray when weathered, gray when fresh, fissile	4.0
9.	Limestone, same as bed 9, *Parapachydiscus* sp. found in this bed	7.1
8.	Marl, same as bed 10	3.0
7.	Limestone, same as bed 9, contains *I. undulatoplicatus*	10.3
6.	Marl, same as bed 8	1.6
5.	Limestone, same as bed 9, stands out as a ledge	7.8
4.	Marl, same as bed 8, contains marcasite-pyrite concretions 0.1 foot long	0.7
3.	Limestone, same as bed 9, contains *I. undulatoplicatus*	1.3

Section 1. (continued from previous page)

2.	Marl, same as bed 8	0.8
1.	Limestone, same as bed 9, lower part not exposed	5.3
	Total	61.8

Section 2. Upper Hemiaster texanus Roemer and Ostrea travisana Stephenson zones, 400 yards downstream from Hutto to Pflugerville road No. 685 crossing Brushy Creek.

Bed	Description	Thickness Feet
	Terrace 2	
14.	Gravel, limestone pebbles, well stratified	5.5
	Unconformity	
13.	Limestone, hard, granular, massive, gray-black when weathered, gray-white when fresh, contains Eutrephoceras sp., Spondylus guadalupae Roemer, Neithea casteeli Kniker, and Idonearca sp.	1.7
12.	Marl, soft, brown when weathered, gray when fresh, fissile, contains marcasite-pyrite concretions 0.1 foot in diameter, and Gryphaea wratheri Stephenson	0.5
11.	Limestone, same as bed 13, contains G. wratheri	2.5
10.	Marl, same as bed 12, limestone concretions present, 0.5 to 0.8 feet long, oblong and flattened, abundant G. wratheri	0.8
9.	Limestone, same as bed 13	4.3
8.	Marl, same as bed 10	0.8
7.	Limestone, same as bed 13	0.5
	Hemiaster texanus Roemer zone	
6.	Marl, soft, gray to brown when weathered, dark gray when fresh, fissile, contains G. wratheri, G. aucella, and S. guadalupae ...	1.0
5.	Limestone, hard, massive, granular, light gray to white when weathered, pale brown when fresh, contains G. wratheri and Eutrephoceras sp.	0.7

Section 2. (continued from previous page)

4.	Marl, same as bed 6	0.3
3.	Limestone, same as bed 5	1.7
2.	Marl, same as bed 6	0.5
1.	Limestone, same as bed 3, base not exposed	3.1
	Total	23.9

Section 3. Ostrea travisana Stephenson zone, in Brushy Creek, 650 yards south of the Lutheran Cemetery.

Bed	Description	Thickness Feet
	Ostrea travisana Stephenson zone	
9.	Limestone, hard, massive, granular, gray when weathered, white when fresh, contains a two inch marly zone eight inches from base	10.1
8.	Marl, soft, yellow-brown when weathered, gray-brown when fresh, contains poorly preserved Gryphaea wratheri Stephenson	0.5
7.	Limestone, same as bed 9, contains Idonearca sp., Neithea casteeli Kniker, and Eutrephoceras sp.	3.4
6.	Marl, same as bed 8	0.5
5.	Limestone, same as bed 9, contains large Inoceramus sp. prisms, Idonearca sp., and Eutrephoceras sp.	2.3
4.	Marl, same as bed 8, contains oblong, flattened limestone concretions 0.6 to 0.8 feet long, and G. wratheri	1.0
3.	Limestone, hard, nodular, granular, gray when weathered, white when fresh, contains shell fragments and G. wratheri	2.0
2.	Marl, same as bed 8, contains G. wratheri	0.5
1.	Limestone, hard, massive, granular, gray-black when weathered, gray-white when fresh, contains G. wratheri and Eutrephoceras sp., base not exposed	1.0
	Total	21.3

Section 4. Section of upper Ostrea travisana, Exogyra ponderosa, Exogyra laeviuscula, and Ostrea centerensis zones of the Austin group, starting at bed of Brushy Creek, 225 yards downstream from iron bridge crossing Brushy Creek, 2.5 miles south of Hutto, and ending on road beside Mexican Cemetery, at the top of Jake's Hill.

Bed	Description	Thickness Feet
	Ostrea centerensis Stephenson zone	
38.	Marl, soft, yellow-brown when weathered, gray-brown when fresh, slightly fissile, glauconitic in lower two feet, Ostrea centerensis abundant	20.0
	Disconformity	
	Exogyra laeviuscula Roemer zone	
37.	Chalk, indurated to soft, gray-brown when weathered, gray when fresh, fine grained, glauconitic, containing Exogyra tigrina Stephenson and marcasite-pyrite concretions 0.1 foot long	1.0
36.	Limestone, hard, gray-white when weathered, white when fresh, massive, fine grained, shelly, containing marcasite-pyrite concretions 0.2 foot long, and numerous E. laeviuscula	3.0
	Exogyra ponderosa Roemer zone	
35.	Limestone, indurated, fine grained, white when weathered, white when fresh, massive, containing E. ponderosa	11.4
34.	Argillaceous chalk, indurated to soft, gray white when weathered, gray when fresh, slightly fissile, containing Terebratulina guadalupae Roemer	3.5
33.	Limestone, same as bed 35, contains a few bore holes	5.7

Section 4. (continued from previous page)

32.	Marl, soft, gray-white when weathered, gray when fresh, fissile	0.5
31.	Argillaceous chalk, same as bed 34	3.3
30.	Marl, same as bed 32	0.3
29.	Argillaceous chalk, indurated massive, gray when weathered, white when fresh, concentration of limonite in upper three inches, containing numerous juvenile <u>Gryphaea</u> <u>aucella</u> Roemer	3.0
28.	Marl, soft, gray when weathered, white when fresh, containing numerous <u>G</u>. <u>aucella</u>	0.2
27.	Argillaceous chalk, same as bed 29	2.0
26.	Marl, same as bed 28	0.1
25.	Argillaceous chalk, same as bed 29	2.5
24.	Limestone, indurated, massive, white, contains numerous mature <u>G</u>. <u>aucella</u>	9.3
23.	Marl, soft, fissile, gray-white when weathered, gray when fresh, contains numerous <u>G</u>. <u>aucella</u>	1.5
22.	Limestone, same as bed 24	2.0
21.	Marl, same as bed 23	0.5
20.	Limestone, same as bed 24	2.7
19.	Limestone, very hard, massive, cream colored when weathered, white when fresh, dense even grained, bore holes numerous towards top	6.5
18.	Marl, soft, fissile, gray-white when weathered, gray when fresh	0.5
17.	Limestone, same as bed 19	3.1
16.	Marl, same as bed 18	0.5
15.	Limestone, same as bed 19	2.8

Section 4. (continued from previous page)

14.	Marl, same as bed 18, a few marcasite-pyrite concretions up to 0.1 foot long	0.5
13.	Limestone, same as bed 19, contains a few _E. ponderosa_	5.5
	Ostrea travisana Stephenson zone	
12.	Marl, soft, blue-gray when weathered, dark gray when fresh, fissile, containing marcasite-pyrite concretions 0.1 foot in diameter	1.1
11.	Limestone, hard, massive, granular, blackish-gray when weathered, gray-white when fresh	0.9
10.	Marl, same as bed 12	0.7
9.	Limestone, same as bed 11, contains bore holes and fucoids	0.9
8.	Marl, same as bed 12	1.2
7.	Limestone, granular, massive, black to gray when weathered, gray when fresh, contains numerous broken shell fragments and _Eutrephoceras_ sp., _Neithea casteeli_ Kniker, _Spondylus guadalupae_ Roemer, _Trigonia_ sp., _Texanites internodosus_ Renz, _T. texanus_ (Roemer) Spath, _Parapuzosia_ sp., forms a prominent ledge	6.0
6.	Marl, same as bed 12, iron stained at places	1.0
5.	Limestone, hard, granular, nodular, white when weathered, gray-white when fresh, contains grains of glauconite, shell fragments, and _Neithea casteeli_ Kniker, and _Spondylus guadalupae_ Roemer	2.0
4.	Marl, same as bed 12	0.7
3.	Limestone, same as bed 5, nodular layer	0.3

Section 4. (continued from previous page)

2.	Marl, same as bed 12, contains oblong limestone concretions up to 0.7 feet long	0.7
1.	Limestone, granular, hard, massive, dark gray when weathered, light gray when fresh, becoming softer and marly toward top, containing small specks of glauconite and Ostrea travisana, base not exposed	2.4
	Total	109.9

Appendix B:

Analytical list of plants

Table 1. Analytical list of plants found on the Austin group and Brushy Creek terraces.

Plants	Geologic Units						
	I.undulato-plicatus	H.texanus	O.travisana	E.ponderosa	E.laeviuscula	O.centerensis	Brushy Creek terraces
Grasses							
Andropogon saccharoides Sw.	5	5	5	3	4	4	3
Andropogon scoparius Michx.	5			4	5	5	3
Aristida glauca (Nees.)Walp.		4	4	5	3		
Aristida longiseta Steud.		3	4		5		
Aristida purpurea Nutt.		3	3	5	4		
Arundo donax L.				5		5	
Bouteloua curtipendula(Michx.)Torr.		4	4	5			4
Bouteloua hirsuta Lag.		5					4
Bouteloua rigidiseta(Steud.)Hitchc.		4	4	5			5
Bromus sp.	5			4	5	5	
Buchloë dactyloides(Nutt.)Engelm.	4	4	4	3	4	4	3
Cynodon Dactylon(L.)Pers.	4			4		4	4
Elymus canadensis L.							3
Elymus virginicus L.							3
Hordeum pusillum Nutt.		5	5	5		5	4
Leptochloa filiformis(Lam.)Beauv.							5
Leptoloma cognatum(Schult.)Chase		4	4	5			5
Muhlenbergia Reverchoni Vasey&Scribn.		5	5	5			
Panicum obtusum H.B.K.		4	5	5			5
Panicum fasciculatum Sw.		4	4	5			
Panicum filipes Scrbn.		5	5				
Panicum reptans L.			4				
Paspalum dilatatum Poir		5	5	5	5		5
Paspalum vaginatum Swartz		4	4				5
Phalaris caroliniana Walt.				5			
Setaria viridis(L.)Beauv.				4			4
Sorhastrum nutans(L.)Nash	5	4		3	4	4	4
Sporobolus asper var.Hookeri(Trin.)Vasey		5	5				
Stipa leucotricha Trin.&Rupr.	5	4	5	5		5	5
Triodia pillosa(Buckl.)Merr.				4	5	4	

Significance of numbers: 1-dominant; 2-subdominant; 3-frequent; 4-infrequent; 5-rare.

Plants	Geologic Units						
	I.undulato-plicatus	H.texanus	O.travisana	E.ponderosa	E.laeviuscula	O.centerensis	Brushy Creek terraces
Trees							
Aesculus Pavia L.		5	5	5			4
Carya Pecan(Marsh.)Engl. & Graebn.	5	5	5	5		5	3
Celtis mississippiensis Bosc.	5	5	5	4		5	3
Cornus asperifolia Michx.							4
Crataegus sp.				5			
Crataegus linaria Sarg.(?)							5
Juniperus virginiana L.	5	4	4				
Maclura pomifera(Raf.)Schneider				5			5
Morus rubra L.							4
Platanus occidentalis L.							4
Prosopis chilensis(Molina)Stuntz.		5	5				5
Ptelea trifoliata L.							5
Quercus macrocarpa Michx.							5
Quercus Schneckii(Britton)Sarg.							5
Quercus virginiana Miller	5			4		4	4
Rulac negundo L.							5
Rulac texana Small							4
Sambucus canadensis L.				5			4
Ulmus americana L.				5			4
Ulmus crassifolia Nutt.							5
Viburnum rufidulum Raf.							5
Forbs							
Acalypha gracilens A.Gray		5		5			
Achillea Millefolium L.				5			
Acnida tamariscina(Nutt.)Wood							5
Allium canadense L.				5			4
Amorpha fruticosa L.	5		5	4	5	5	
Amphiachyris dracunculoides DC.	4	3	3	3	4	3	4
Argemone platyceras Link&Otto	4			4			
Aster exilis Ell.		5	5	4	5	4	4
Bellis integrifolia Michx.	5	5	5				
Bifora americanna(DC.)B.&H.		4	5				5
Boerhaavia decumbens Vahl.	5						
Callirrhoe geranioides Small				5			5
Carduus austrinus Small	5		5	5			
Cassia Roemeriana Scheele		4	4				4
Convolvulus sp.	5			4		4	3

Significance of numbers: 1-dominant; 2-subdominant; 3-frequent; 4-infrequent; 5-rare.

Plants	Geologic Units						
	I.undulato-plicatus	H.texanus	O.travisana	E.ponderosa	E.laeviuscula	O.centerensis	Brushy Creek terraces
Commelina angustifolia Michx.	5			4		4	3
Commelina crispa Wooton	5			5			3
Croton monanthogynus Michx.		5		4		5	4
Delphinium(Cult.)		5	5				
Engelmannia pinatifida T.&G.	4	5	5	4	5	4	3
Erigeron philadelphicus L.	4	5	5	4	4	4	4
Eryngium Leavenworthii T.&G.		5	5				
Gaillardia puchella Foug.	4			3		3	3
Gaillardia suavis(Gray&Engelm.)Br.&Ru.				5			4
Galium Aparine L.				4	5		4
Gaura sp.	5			5		5	5
Gaura suffulta Engelm.		5	5	4	5	4	
Gerardia heterophylla Nutt.			5				
Gutierrezia texana T.&G.	4	3	3	4	3	3	4
Hartmannia speciosa Small	4			4		4	4
Helianthus annuus L.	4	5	5	4	5	4	5
Ipomoea trifida(H.B.K.)G.Don	4			4			3
Indigofera leptosepala Nutt.		5					4
Iva angustifolia Nutt.				4			4
Krameria secundiflora DC.		5	5				
Lepadenia bicolor(Engelm.&Gray)Nieuw	5			4		5	4
Lesquerella gracilis(Hook.)S.Wats.	4	5	5	3		3	3
Lindheimera texana Engelm&Gray			5	5			
Liatris mucronata DC.			5				
Lygodesmia texana(T.&G.)Greene				4			4
Malvaviscus Drumondii T.&G.							5
Marrubium vulgare L.				4			3
Medicago hispida Gaertn.	4	4	4	3	4	4	4
Melilotus indica(L.)All.	5			5			4
Monarda dispersa Small		5	5	5		5	
Opuntia lindheimeri Engelm.		3	3		5		
Parthenium hysterophorus L.				4	5		3
Persicaria punctata(Ell.)Small				5			5
Petalostemon multiflorus Nutt.				4	5		
Phytolacca decandra L.							4
Pinaropappus roseus Less				5			

Significance of numbers: 1-dominant; 2-subdominant; 3-frequent; 4-infrequent; 5-rare.

Plants	Geologic Units						
	I.undulato-plicatus	H.texanus	O.travisana	E.ponderosa	E.laeviuscula	O.centerensis	Brushy Creek terraces
Plantago rhodosperma Decne	5		5	4			4
Polypteris callosa(Nutt.)A.Gray				5			
Ratibida columnaris(Sims)T.&G.	4		5	4		5	4
Ruellia Drummondiana(Nees)A.Gray		5	5				
Salvia farinaceae Benth.	4	4	4	3	4	3	3
Scutellaria Drummondii Benth.				4			4
Senecio lobatus Pers.	4			3		4	3
Sida procumbens Sw.			5				
Sitilias multicaulis(DC.)Greene	4			4			4
Sonchus asper(L.)All.			4	3		4	
Solanum elaeagnifolium Cav.	5		5	4		5	4
Solanum Torreyi A.Gray	4	5	4	3	5	4	5
Solanum rostratum Dunal		3	3	4	3		5
Specularia perfoliata(L.)A. DC.	4		5	3		4	
Thelesperma trifidum(Poir.)Britton				4			4
Tradescantia gigantea Rose	5		5				
Velerianella amarella Krok.		4	4	4	5		4
Verbena bipinatifida Nutt.	3	4	4	3		3	4
Verbena Halei Small				5			
Verbesina virginica L.	4			4			4
Vernonia interior(Small)Schubert		4	4	5		5	
Viorna pitcheri							5
Xanthium speciosum Kearney	5	4	4	5	4	4	
Yucca arkansana Trel .		3	3	5	3	5	

Significance of numbers: 1-dominant; 2-subdominant; 3-frequent; 4-infrequent; 5-rare.


Plate I
GEOLOGY OF
HUTTO QUADRANGLE
WILLIAMSON COUNTY, TEXAS
JAMES E. GORDON
JUNE, 1951
EXPLANATION
Qal
Alluvium
(recent stream deposits)
Qbt
"Brushy Creek" terraces
(gravel and sand)
Qug
"Upland" gravels
(siliceous gravels)
QUATERNARY
UNCONFORMITY
Taylor marl
Kta
(blue-black marl)
Burditt marl
Kbda
Ostrea centerensis
(buff marl)
DISCONFORMITY
Austin group
Austin chalk
Kaug
Exogyra laeviuscula
(shelly, white chalk)
Kauf
Exogyra ponderosa
(fine, white chalk)
Kaue
Ostrea travisana
(granular chalk)
Kaud
Hemiaster texanus
(granular chalk)
Kauc
Inoceramus undulato-plicatus
(fine, white chalk)
CRETACEOUS
intermittent stream
flowing stream
railroad
all weather road
private road
geologic contact
inferred contact
concealed contact
fault
inferred fault
concealed fault
house, church, school
cemetery
gravel pit
water tank
measured section
fossil locality
dry oil well
BM bench mark
97°35'
97°30'
30°35'
30°30'
Hutto
W.W. Reeves Stern No. 1
W.M. Jarrell Avery No. 1
Jonah Fault
Brushy Creek Fault
Shilo Fault
Brushy Creek
Cottonwood Creek
South Fork Mustang Creek
Little Mustang Creek
To Jonah
To Taylor
To Round Rock
To Pflugerville
To Rice's Crossing
U.S. HIGHWAY 79
INTERNATIONAL AND GREAT NORTHERN R.R.
BM 669
BM 656
BM 639
LUTHERAN CEM.
HUTTO CEM.
MEXICAN CEM.
SHILO CEM.
Ray's Bluff
WILLIAMSON CO.
TRAVIS CO.
FARM ROAD 685
Scale 1/20000
0 ½ 1 MILE
0 400 800 1200 1600 YARDS
Base Map from
USGS Topographic Map
USDA Aerial Photographs
TRUE NORTH
MAGNETIC NORTH
9° 35'
FEET
Lower Cretaceous
A
A'
B
B'

Plate 2

COMPOSITE SECTION

AUSTIN GROUP

HUTTO QUADRANGLE

WILLIAMSON COUNTY, TEXAS

James F. Gordon June, 1951

Written descriptions in Appendix A

LEGEND

- Limestone, fine grained, hard, massive, white to gray
- Limestone, granular, hard, massive, brown to gray
- Chalk, argillaceous, soft, gray to brown
- Marl, fissile, soft, brown to gray
- Gravel, limestone pebbles, well bedded (Quaternary)

Ostrea centerensis
Exogyra ponderosa
Exogyra laeviuscula
Ostrea travisana
Inoceramus undulatoplicatus
Gryphaea aucella (juvenile shells)
Texanites internodosus
Spondylus guadalupae
Neithea casteeli

The vita has been removed from the digitized version of this document.